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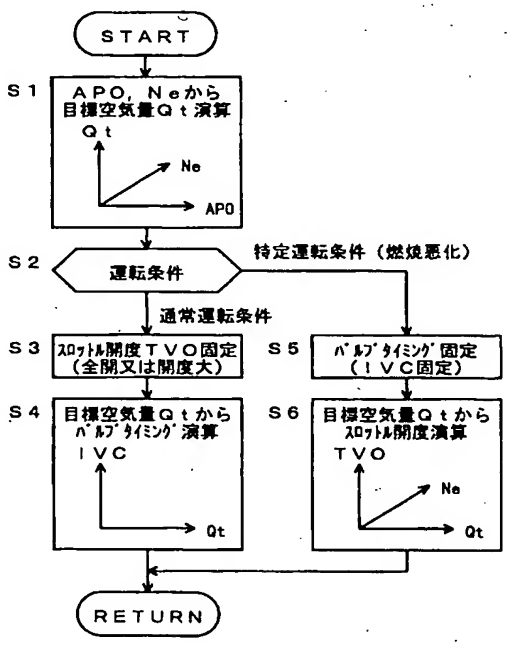
(54)【発明の名称】　可変動弁エンジンの制御装置

(57)【要約】
【課題】　可変動弁エンジンにおいて、吸気弁による吸入空気量の制御によって吸気弁の開期間が短くなることから燃焼状態が悪化する特定運転条件にて、スロットル弁を用いて、燃焼状態を改善する。
【解決手段】　吸気弁による吸入空気量の制御によって燃焼状態が悪化する特定運転条件（アイドル運転時、及び／又は、冷機状態での低負荷運転時）か、それ以外の通常運転条件かを判定する（Ｓ２）。通常運転条件の場合は、スロットル開度ＴＶＯを全開近傍に固定し（Ｓ３）、目標空気量Ｑｔを得るように、吸気弁の閉時期ＩＶＣを制御する（Ｓ４）。特定運転条件の場合は、吸気弁の閉時期ＩＶＣを下死点近傍に固定し（Ｓ５）、目標空気量Ｑｔを得るように、スロットル開度ＴＶＯを制御する（Ｓ６）。



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【特許請求の範囲】

【請求項１】吸気弁の開閉動作を任意に制御可能な可変動弁装置を備え、吸気弁の閉時期を制御して吸入空気量を制御可能な可変動弁エンジンの制御装置において、

吸気弁による吸入空気量の制御によって燃焼状態が悪化する特定運転条件かそれ以外の通常運転条件かを判定する運転条件判定手段と、

前記通常運転条件にて、吸気弁の閉時期を制御して吸入空気量を制御する第１の吸入空気量制御手段と、

前記特定運転条件にて、吸気弁の閉時期を固定し、吸気通路に設けたスロットル弁の開度を制御して吸入空気量を制御する第２の吸入空気量制御手段と、

を設けたことを特徴とする可変動弁エンジンの制御装置。

【請求項２】前記特定運転条件を、アイドル運転時とすることを特徴とする請求項１記載の可変動弁エンジンの制御装置。

【請求項３】前記特定運転条件を、冷機状態での低負荷運転時とすることを特徴とする請求項１記載の可変動弁エンジンの制御装置。

【請求項４】前記第１の吸入空気量制御手段は、吸気弁による吸入空気量の制御中、スロットル弁を全開近傍に固定することを特徴とする請求項１～請求項３のいずれか１つに記載の可変動弁エンジンの制御装置。

【請求項５】前記第２の吸入空気量制御手段は、吸気弁の閉時期を下死点近傍に固定することを特徴とする請求項１～請求項３のいずれか１つに記載の可変動弁エンジンの制御装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、吸気弁の開閉動作を任意に制御可能な可変動弁装置を備え、吸気弁の閉時期を制御して吸入空気量を制御可能な可変動弁エンジンにおいて、特定運転条件での吸気弁による吸入空気量の制御による燃焼状態の悪化を防止するための制御装置に関する。

【０００２】

【従来の技術】従来より、可変動弁装置、例えば電磁駆動装置を用いて、吸気弁及び排気弁を駆動し、これらの開閉動作を任意に制御するものがある（特開平１０－３７７２７号公報参照）。

【０００３】更に、近年は、ポンプロスの低減による燃費向上を目的として、吸気弁の閉時期を制御（早閉じ制御）することにより、吸入空気量を制御して、ノンスロットル運転を行うものが注目され、その開発が進められている。この場合、スロットル弁は無いか、吸気通路内に微少な負圧を得る目的で補助的に装着される。

【０００４】

【発明が解決しようとする課題】しかしながら、可変動弁装置を用いて、吸入空気量を吸気弁の閉時期で制御する場合、低負荷運転時には、吸入空気量を小さくすべく、吸気弁の閉時期が早くなって、吸気弁の開時間が短くなるため、以下のような現象を生じる。

（１）吸気弁の開時間が短いため、ポート流速が発達せず、シリンダ内のガス流動の弱化を生じる。

（２）同様の理由で、吸気ポートへ付着した燃料（壁流）の気化が鈍化する。

（３）吸気弁の早閉じ後の断熱膨張等により、シリンダ内混合気の温度低下を生じる。

【０００５】また、上記現象は、アイドル運転時や、冷機状態において影響が大きくなり、燃焼の悪化を招き、運転性、燃費等に影響を与える。本発明は、このような点に鑑み、可変動弁エンジンにおける特定運転条件での燃焼状態の悪化を防止することを目的とする。

【０００６】

【課題を解決するための手段】このため、請求項１に係る発明では、吸気弁の開閉動作を任意に制御可能な可変動弁装置を備え、吸気弁の閉時期を制御して吸入空気量を制御可能な可変動弁エンジンの制御装置において、図１に示すように、吸気弁による吸入空気量の制御によって燃焼状態が悪化する特定運転条件かそれ以外の通常運転条件かを判定する運転条件判定手段と、前記通常運転条件にて、吸気弁の閉時期を制御して吸入空気量を制御する第１の吸入空気量制御手段と、前記特定運転条件にて、吸気弁の閉時期を固定し、吸気通路に設けたスロットル弁の開度を制御して吸入空気量を制御する第２の吸入空気量制御手段と、を設けたことを特徴とする。

【０００７】請求項２に係る発明では、前記特定運転条件を、アイドル運転時とすることを特徴とする。請求項３に係る発明では、前記特定運転条件を、冷機状態での低負荷運転時とすることを特徴とする。

【０００８】請求項４に係る発明では、前記第１の吸入空気量制御手段は、吸気弁による吸入空気量の制御中、スロットル弁を全開近傍に固定することを特徴とする。請求項５に係る発明では、前記第２の吸入空気量制御手段は、吸気弁の閉時期を下死点近傍に固定することを特徴とする。

【０００９】

【発明の効果】請求項１に係る発明によれば、通常運転条件では、吸気弁の閉時期を制御して吸入空気量を制御する一方、吸気弁による吸入空気量の制御によって燃焼状態が悪化する特定運転条件では、吸気弁の閉時期を固定して、吸気弁の開時間を長くとり、そのままでは増加してしまう吸入空気量については、スロットル弁の開度により制御（絞り制御）することで、吸気弁の開時間を確保してポート流速を十分に発達させる等により、シリンダ内のガス流動向上、壁流の霧化促進、シリンダ内混合気の温度上昇を図り、燃焼状態を改善することができる。

【００１０】請求項２に係る発明によれば、アイドル運

転時に、スロットル弁による吸入空気量の制御を行うことで、吸気弁による吸入空気量の制御で燃焼状態の悪化が顕著となるアイドルでの燃焼を改善し、アイドル安定性等を向上できる。

【００１１】請求項３に係る発明によれば、冷機状態での低負荷運転時に、スロットル弁による吸入空気量の制御を行うことで、吸気弁による吸入空気量の制御で燃焼状態の悪化が顕著となる冷機状態での燃焼を改善し、運転性等を向上できる他、冷機状態では可変動弁装置の制御性の悪化により微細な空気量制御が困難となるという問題も解決できる。

【００１２】請求項４に係る発明によれば、吸気弁による吸入空気量の制御中、スロットル弁を全開近傍に固定することで、ポンプロス低減効果を十分に発揮させることができる。

【００１３】請求項５に係る発明によれば、スロットル弁による吸入空気量の制御中、吸気弁の閉時期を下死点近傍に固定することで、吸気弁の開時間を十分に確保して、ガス流動の強化等を図ることができる。

【００１４】

【発明の実施の形態】以下に本発明の実施の形態を説明する。図２は本発明の一実施形態を示す可変動弁エンジンのシステム図である。

【００１５】エンジン１の各気筒のピストン２により画成される燃焼室３には、点火栓４を囲むように、電磁駆動式の吸気弁５及び排気弁６を備えている。７は吸気通路、８は排気通路である。

【００１６】吸気弁５及び排気弁６の電磁駆動装置（可変動弁装置）の基本構造を図３に示す。弁体２０の弁軸２１にプレート状の可動子２２が取付けられており、この可動子２２はスプリング２３，２４により中立位置に付勢されている。そして、この可動子２２の下側に開弁用電磁コイル２５が配置され、上側に閉弁用電磁コイル２６が配置されている。

【００１７】従って、開弁させる際は、上側の閉弁用電磁コイル２６への通電を停止した後、下側の開弁用電磁コイル２５に通電して、可動子２２を下側へ吸着することにより、弁体２０をリフトさせて開弁させる。逆に、閉弁させる際は、下側の開弁用電磁コイル２５への通電を停止した後、上側の閉弁用電磁コイル２６に通電して、可動子２２を上側へ吸着することにより、弁体２０をシート部に着座させて閉弁させる。

【００１８】図２に戻って、吸気通路７には、全気筒共通の集合部に、電制スロットル弁９が設けられている。吸気通路７にはまた、各気筒毎の吸気ポート部分に、電磁式の燃料噴射弁１０が設けられている。

【００１９】ここにおいて、吸気弁５、排気弁６、電制スロットル弁９、燃料噴射弁１０及び点火栓４の作動は、コントロールユニット１１により制御され、このコントロールユニット１１には、エンジン回転に同期してクランク角信号を出力しこれによりクランク角位置と共にエンジン回転数Ｎｅを検出可能なクランク角センサ１２、アクセル開度（アクセルペダル踏込み量）ＡＰＯを検出するアクセルペダルセンサ（アクセル全閉でＯＮとなるアイドルスイッチを含む）１３、吸気通路７のスロットル弁９上流にて吸入空気量Ｑａを計測するエアフローメータ１４、エンジン冷却水温Ｔｗを検出する水温センサ１５等から、信号が入力されている。



【００２０】このエンジン１では、通常は、ポンプロスの低減による燃費向上を目的として、電磁駆動式の吸気弁５及び排気弁６の開閉動作を制御、特に吸気弁５の開時期ＩＶＯを上死点近傍に設定して、吸気弁５の閉時期ＩＶＣを可変制御することにより吸入空気量を制御して、実質的にノンスロットル運転を行う。この場合、電制スロットル弁９は、全開、又は吸気通路７内に微少な負圧を得る程度の開度に設定する。

【００２１】一方、吸気弁５の閉時期ＩＶＣによる吸入空気量の制御によって燃焼状態が悪化する特定運転条件、具体的には、アイドル運転時、及び／又は、冷機状態（水温Ｔｗが所定値以下）での低負荷運転時には、吸気弁５の閉時期ＩＶＣを下死点近傍に固定し、電制スロットル弁９の開度ＴＶＯを可変制御することにより吸入空気量を制御する。

【００２２】燃料噴射弁１０の燃料噴射時期及び燃料噴射量は、エンジン運転条件に基づいて制御するが、燃料噴射量は、基本的には、エアフローメータ１４により計測される吸入空気量Ｑａに基づいて、所望の空燃比となるように制御する。

【００２３】点火栓４による点火時期は、エンジン運転条件に基づいて、ＭＢＴ（トルク上の最適点火時期）又はノック限界に制御する。次に、吸気弁５（吸気弁開時期ＩＶＯ、閉時期ＩＶＣ）及び電制スロットル弁９（スロットル開度ＴＶＯ）の制御について、更に詳細に、図４のフローチャートにより説明する。

【００２４】ステップ１（図にはＳ１と記す。以下同様）では、アクセル開度ＡＰＯとエンジン回転数Ｎｅとに基づいて、マップを参照して、要求トルク相当の目標空気量Ｑｔを演算する。但し、アイドル運転時（アイドルスイッチＯＮ）の場合は、エンジン回転数Ｎｅと目標アイドル回転数Ｎｉｄｌｅとの偏差ΔＮｅ＝Ｎｅ－Ｎｉｄｌｅに基づいて、該偏差がマイナス側のときは、増量方向、プラス側のときは、減量方向に、目標空気量Ｑｔを補正する。

【００２５】ステップ２では、運転条件を判定する。すなわち、吸気弁５による吸入空気量の制御によって燃焼状態が悪化する特定運転条件かそれ以外の通常運転条件かを判定する。ここで、前記特定運転条件は、アイドル運転時（アイドルスイッチＯＮ）、及び／又は、冷機状態（水温Ｔｗが所定値以下）での低負荷運転時（目標空気量Ｑｔが所定値以下）とする。この部分が運転条件判

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定手段に相当する。

【００２６】通常運転条件の場合は、ステップ３へ進み、スロットル開度ＴＶＯを全開近傍（全開又は微少な負圧を得る程度の開度）に固定する。そして、ステップ４へ進み、ステップ３でのスロットル開度条件下で、目標空気量Ｑｔを得るように、バルブタイミングを演算する。すなわち、吸気弁開時期ＩＶＯを上死点近傍に固定する一方、目標空気量Ｑｔを得るように、目標空気量Ｑｔから、吸気弁閉時期ＩＶＣを演算し、制御する。ここで、目標空気量Ｑｔが小さい程、吸気弁閉時期ＩＶＣを上死点側に設定し、目標空気量Ｑｔが大きい程、吸気弁閉時期ＩＶＣを下死点側に設定する。このステップ３，４の部分が第１の吸入空気量制御手段に相当する。

【００２７】特定運転条件の場合は、ステップ５へ進み、バルブタイミングを固定する。すなわち、吸気弁開時期ＩＶＯを上死点近傍に固定し、吸気弁閉時期ＩＶＣを下死点近傍に固定する。

【００２８】そして、ステップ６へ進み、ステップ５でのバルブタイミング条件下で、目標空気量Ｑｔを得るように、スロットル開度ＴＶＯを演算する。すなわち、目標空気量Ｑｔとエンジン回転数Ｎｅとから、マップを参照して、スロットル開度ＴＶＯを演算し、制御する。具体的には、Ｑｔ／Ｎｅに対し比例的にスロットル開度ＴＶＯを設定する。このステップ５，６の部分が第２の吸入空気量制御手段に相当する。

【００２９】以上のように、可変動弁装置を用いて、吸入空気量を吸気弁５の閉時期ＩＶＣで制御する場合、低負荷運転時には、吸入空気量を小さくすべく、吸気弁５の閉時期ＩＶＣが早くなって、吸気弁の開時間（ＩＶＯ～ＩＶＣ）が短くなるため、図５のＡに示すように、ポート流速が発達せず、シリンダ内のガス流動の弱化や、壁流の気化の鈍化等を生じるが、本発明では、このときに、吸気弁５の閉時期ＩＶＣを下死点近傍に固定して、吸気弁５の開時間を長くとることで、図５のＢに示すように、ポート流速を十分に発達させて、シリンダ内のガス流動向上、壁流の霧化促進等を図る。そして、そのままでは増加してしまう吸入空気量については、電制スロットル弁９で空気量を絞り制御することで、同一の吸入空気量を得るのである。

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【００３０】尚、吸気弁による制御からスロットル弁による制御に切換える特定運転条件としては、アイドル運転時や、冷機状態での低負荷運転時の他、減速運転時（燃料カット前）を挙げることができる。

【００３１】また、本実施形態では、可変動弁装置として、電磁駆動式のものを用いたが、油圧駆動式のもの等を用いることもできる。

【図面の簡単な説明】

【図１】　本発明の構成を示す機能ブロック図

【図２】　本発明の一実施形態を示す可変動弁エンジンのシステム図

【図３】　吸排気弁の電磁駆動装置の基本構造図

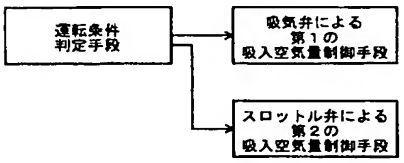
【図４】　制御ルーチンのフローチャート

【図５】　吸気弁の開時間とポート流速等との関係を示す図

【符号の説明】

１　エンジン
４　点火栓
５　電磁駆動式の吸気弁
６　電磁駆動式の排気弁
７　吸気通路
８　排気通路
９　燃料噴射弁
１０　電制スロットル弁
１１　コントロールユニット
１２　クランク角センサ
１３　アクセルペダルセンサ
１４　エアフローメータ
１５　水温センサ

【図１】

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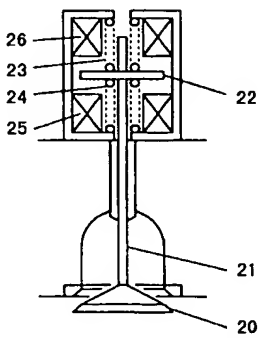

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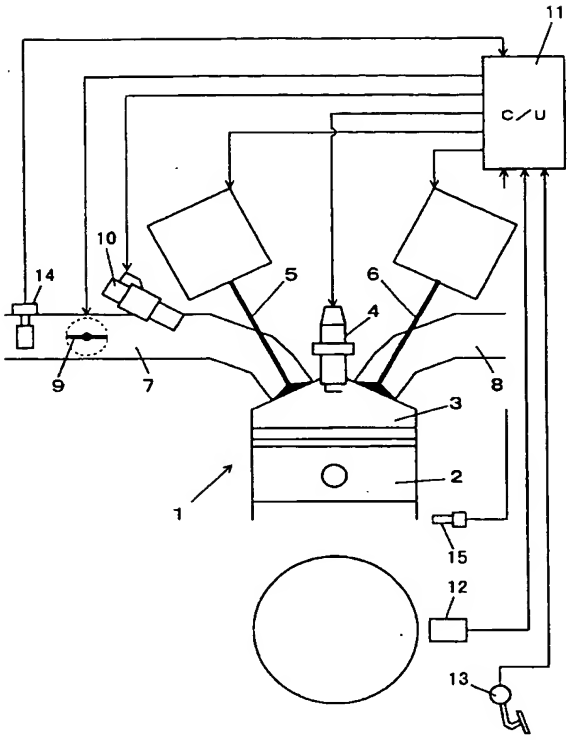


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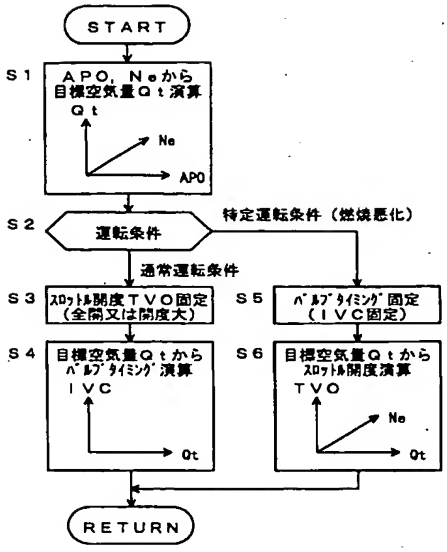


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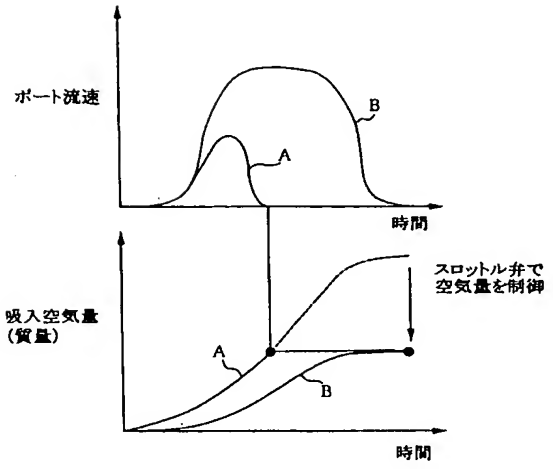


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EA09 GA05 GA09 GA10 GA46
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DA28 EB09 EB12 FA07 FA10
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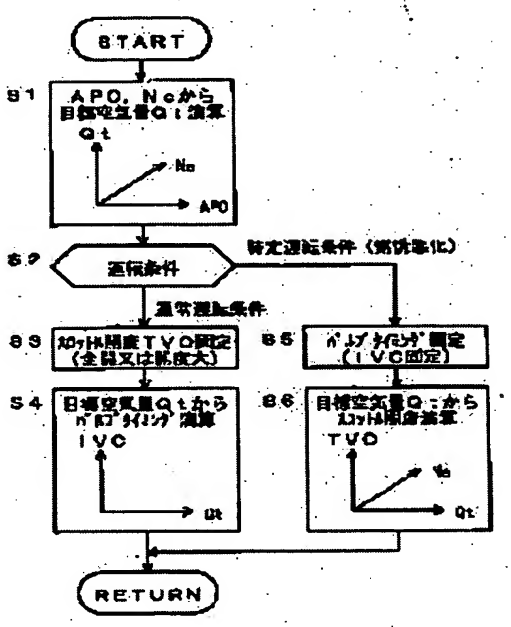
NAGAISHI HATSUO

## (54) CONTROL DEVICE FOR VARIABLE VALVE SYSTEM ENGINE

(57)Abstract:

PROBLEM TO BE SOLVED: To improve a combustion state using a throttle valve in a specific operating condition wherein the combustion state is worsened by the shortened open period of the intake valve due to the control of intake air quantity by an intake valve in a variable valve system engine.

SOLUTION: Whether an operating condition is a specific operating condition (in idling operation and/or in low load operation in a cold state) wherein a combustion state is worsened by the control of intake air quantity by the intake valve, or a normal operating condition other than that is judged (S2). In the case of the normal operating condition, throttle opening TVO is fixed close to full opening (SS), and the closing timing IVC of the intake valve is controlled to obtain the target air quantity Qt (S4). In the case of the specific operating condition, the closing timing IVC of the intake valve is fixed close to the bottom dead center (S5), and the throttle opening TVO is controlled to obtain the target air quantity Qt (S6).



LEGAL STATUS

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| [Date of registration] | |
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CLAIMS

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[Claim(s)]
[Claim 1] Arbitration is equipped with a controllable adjustable moving valve mechanism for a switching action of an inlet valve characterized by providing the following, a close stage of an inlet valve is controlled, and it is the control unit of a controllable adjustable valve train engine about an inhalation air content. A service-condition judging means to judge a specific service condition to which a combustion condition gets worse by control of an inhalation air content by inlet valve, or the other usual service condition The 2nd inhalation air content control means which fixes a close stage of an inlet valve, controls opening of a throttle valve prepared in an inhalation-of-air path by the 1st [ said ] inhalation air content control means and said specific service condition which controls a close stage of an inlet valve by service condition, and usually controls an inhalation air content by it, and controls an inhalation air content by them
[Claim 2] A control unit of an adjustable valve train engine according to claim 1 characterized by considering said specific service condition as the time of idle operation.
[Claim 3] A control unit of an adjustable valve train engine according to claim 1 characterized by considering said specific service condition as the time of low load operation in the cold machine condition.
[Claim 4] Said 1st inhalation air content control means is the control unit of an adjustable valve train engine of any one publication of claim 1 characterized by fixing a throttle valve near the full open during control of an inhalation air content by inlet valve - claim 3.
[Claim 5] Said 2nd inhalation air content control means is the control unit of an adjustable valve train engine of any one publication of claim 1 characterized by fixing a close stage of an inlet valve near the bottom dead point - claim 3.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to the control unit for equipping arbitration with a controllable adjustable moving valve mechanism for the switching action of an inlet valve, controlling the close stage of an inlet valve, and preventing aggravation of the combustion condition by control of the inhalation air content according an inhalation air content to the inlet valve in a specific service condition in a controllable adjustable valve train engine.
[0002]
[Description of the Prior Art] the former -- an adjustable moving valve mechanism, for example, electromagnetism, -- using a driving gear, an inlet valve and an exhaust valve are driven and there are some which control these switching actions to arbitration (refer to JP,10-37727,A).
[0003] Furthermore, by controlling the close stage of an inlet valve in recent years for the purpose of the improvement in fuel consumption by reduction of a pump loss (already closing control), an inhalation air content is controlled, what performs non throttle operation attracts attention, and the development is furthered. In this case, it is equipped with a throttle valve auxiliary in order for there to be nothing or to obtain very small negative pressure in an inhalation-of-air path.
[0004]
[Problem(s) to be Solved by the Invention] However, at the time of low load operation, when controlling an inhalation air content by the close stage of an inlet valve using an adjustable moving valve mechanism, since the close stage of an inlet valve becomes early and the open time amount of an inlet valve becomes short that an inhalation air content should be made small, the following phenomena are produced.
(1) Since the open time amount of an inlet valve is short, the port rate of flow does not progress but produce weakening of the gas fluid in a cylinder.
(2) In the same reason, evaporation of the fuel (wall style) adhering to a suction port becomes slow.
(3) An inlet valve already closes and produce the temperature fall of gaseous mixture in a cylinder by a next adiabatic expansion etc.
[0005] Moreover, in the time of idle operation, and a cold machine condition, effect becomes large, aggravation of combustion is caused and, as for the above-mentioned phenomenon, operability, fuel consumption, etc. are affected. This invention aims at preventing aggravation of the combustion condition in the specific service condition in an adjustable valve train engine in view of such a point.
[0006]
[Means for Solving the Problem] For this reason, equip arbitration with a controllable adjustable moving valve mechanism for a switching action of an inlet valve, control a close stage of an inlet valve by invention concerning claim 1, and an inhalation air content is set to a control unit of a controllable adjustable valve train engine. A service-condition judging means to judge a specific service condition to which a combustion condition gets worse by control of an inhalation air content by inlet valve, or the other usual service condition as shown in drawing 1 , Said 1st inhalation air content control means

which controls a close stage of an inlet valve by service condition, and usually controls an inhalation air content by it, It is characterized by establishing the 2nd inhalation air content control means which fixes a close stage of an inlet valve, controls opening of a throttle valve prepared in an inhalation-of-air path by said specific service condition, and controls an inhalation air content by it.
[0007] In invention concerning claim 2, it is characterized by considering said specific service condition as the time of idle operation. In invention concerning claim 3, it is characterized by considering said specific service condition as the time of low load operation in the cold machine condition.
[0008] In invention concerning claim 4, said 1st inhalation air content control means is characterized by fixing a throttle valve near the full open during control of an inhalation air content by inlet valve. In invention concerning claim 5, said 2nd inhalation air content control means is characterized by fixing a close stage of an inlet valve near the bottom dead point.
[0009]
[Effect of the Invention] According to invention concerning claim 1, usually in a service condition While controlling the close stage of an inlet valve and controlling an inhalation air content, in the specific service condition to which a combustion condition gets worse by control of the inhalation air content by the inlet valve About the inhalation air content which increases if the close stage of an inlet valve is fixed, the long open time amount of an inlet valve is taken and it remains as it is By controlling by opening of a throttle valve (throttling control), the temperature rise of gaseous mixture can be planned in the improvement in gas fluid in a cylinder, the promotion of atomization of a wall style, and a cylinder by securing the open time amount of an inlet valve and fully developing the port rate of flow etc., and a combustion condition can be improved.
[0010] According to invention concerning claim 2, at the time of idle operation, combustion by the idle from whom aggravation of a combustion condition becomes remarkable is improved by control of the inhalation air content by the inlet valve, and idle stability etc. can be improved by controlling the inhalation air content by the throttle valve.
[0011] Combustion in the cold machine condition that aggravation of a combustion condition becomes remarkable is improved by control of the inhalation air content by the inlet valve, and, according to invention concerning claim 3, can improve operability etc. by controlling the inhalation air content by the throttle valve at the time of low load operation in the cold machine condition, and also the problem that where of detailed air content control becomes difficult according to aggravation of the controllability of an adjustable moving valve mechanism is solvable in a cold machine condition.
[0012] According to invention concerning claim 4, the pump loss reduction effect can fully be demonstrated by fixing a throttle valve near the full open during control of the inhalation air content by the inlet valve.
[0013] According to invention concerning claim 5, during control of the inhalation air content by the throttle valve, the open time amount of an inlet valve can fully be secured, and gas fluid can be strengthened by fixing the close stage of an inlet valve near the bottom dead point.
[0014]
[Embodiment of the Invention] The gestalt of operation of this invention is explained below. Drawing 2 is the system chart of the adjustable valve train engine in which 1 operation gestalt of this invention is shown.
[0015] an ignition plug 4 is surrounded in the combustion chamber 3 formed by the piston 2 of each gas column of an engine 1 -- as -- electromagnetism -- it has drive-type an inlet valve 5 and an exhaust valve 6. 7 is an inhalation-of-air path and 8 is a flueway.
[0016] the electromagnetism of an inlet valve 5 and an exhaust valve 6 -- the basic structure of a driving gear (adjustable moving valve mechanism) is shown in drawing 3 . The plate-like needle 22 is attached in the valve stem 21 of a valve element 20, and this needle 22 is energized by the center valve position with springs 23 and 24. and this needle 22 bottom -- the object for valve opening -- electromagnetism -- a coil 25 arranges -- having -- a top -- the object for clausiliums -- electromagnetism -- the coil 26 is arranged.
[0017] therefore, the time of making it open -- the object for upper clausiliums -- electromagnetism --

the object for valve opening of the bottom after stopping the energization to a coil 26 -- electromagnetism -- the lift of the valve element 20 is carried out, and it is made to open by energizing in a coil 25 and adsorbing a needle 22 with the down side on the contrary, the time of carrying out clausilium -- the object for lower valve opening -- electromagnetism -- the object for the clausiliums of the top after stopping the energization to a coil 25 -- electromagnetism -- by energizing in a coil 26 and adsorbing a needle 22 with the up side, the sheet section is sat and clausilium of the valve element 20 is carried out.

[0018] It returns to drawing 2 and the ** system throttle valve 9 is formed in the inhalation-of-air path 7 at the set section common to all gas columns. The electromagnetic fuel injection valve 10 is formed in the inhalation-of-air path 7 again at the suction-port portion for every gas column.

[0019] In here actuation of an inlet valve 5, an exhaust valve 6, the ** system throttle valve 9, a fuel injection valve 10, and an ignition plug 4 It is controlled by the control unit 11. To this control unit 11 A crank angle signal is outputted synchronizing with engine rotation. By this with a crank angle location An engine speed Ne In the throttle-valve 9 upstream of the detectable crank angle sensor 12, the accelerator pedal sensor (the idle switch which serves as ON by the accelerator close by-pass bulb completely is included) 13 which detects the accelerator opening (the amount of accelerator pedal treading in) APO, and the inhalation-of-air path 7, the inhalation air content Qa Coolant temperature sensor 15 grade to the signal which detects the air flow meter 14 to measure and engine-cooling-water ** Tw is inputted.

[0020] a purpose [ improvement / in fuel consumption / usually according to reduction of a pump loss with this engine 1 ] -- carrying out -- electromagnetism -- control, especially the open stage IVO of an inlet valve 5 are set up for the switching action of the inlet valve 5 of a drive type, and an exhaust valve 6 near the top dead center, by carrying out adjustable control of the close stage IVC of an inlet valve 5, an inhalation air content is controlled and non throttle operation is performed substantially. In this case, the ** system throttle valve 9 is set as the opening of a degree which obtains very small negative pressure in full open or the inhalation-of-air path 7.

[0021] On the other hand, at the time of idle operation and/or low load operation in the cold machine condition (water temperature Tw below a predetermined value), the close stage IVC of an inlet valve 5 is fixed near the bottom dead point, and, specifically, an inhalation air content is controlled at it the specific service condition to which a combustion condition gets worse by control of the inhalation air content by the close stage IVC of an inlet valve 5, and by carrying out adjustable control of the opening TVO of the ** system throttle valve 9.

[0022] Although the fuel injection timing and fuel oil consumption of a fuel injection valve 10 are controlled based on engine operation conditions, fundamentally, fuel oil consumption is controlled based on the inhalation air content Qa measured by the air flow meter 14 to become a desired air-fuel ratio.

[0023] The ignition timing by the ignition plug 4 is controlled to MBT (the optimal ignition timing on torque), or a knock limit based on engine operation conditions. Next, the flow chart of drawing 4 explains further control of an inlet valve 5 (the inlet-valve open stage IVO, close stage IVC) and the ** system throttle valve 9 (throttle opening TVO) to details.

[0024] Step 1 (it is described in drawing as S1.) Based on the accelerator opening APO and an engine speed Ne at it being the same as that of the following, the aim air content Qt of demand torque is calculated with reference to a map. However, when this deflection is a minus side based on deflection deltaNe=Ne-Nidle of an engine speed Ne and aim idle rpm Nidle for the case at the time of idle operation (idle switch ON), the aim air content Qt is amended in the loss-in-quantity direction at the time of the increase-in-quantity direction side and a plus side.

[0025] A service condition is judged at step 2. That is, the specific service condition or the other usual service condition to which a combustion condition gets worse by control of the inhalation air content by the inlet valve 5 is judged. Here, said specific service condition is taken as the time of idle operation and/or low load operation in the cold machine condition (water temperature Tw below a predetermined value) (idle switch ON) (the aim air content Qt below a predetermined value). This portion is equivalent

to a service-condition judging means.
[0026] Usually, in the case of a service condition, it progresses to step 3, and it fixes the throttle opening TVO near the full open (opening of a degree which obtains full open or very small negative pressure). And it progresses to step 4, and valve timing is calculated so that the aim air content Qt may be acquired under the throttle opening conditions in step 3. That is, while the inlet-valve open stage IVO is fixed near the top dead center, the inlet-valve close stage IVC is calculated and controlled from the aim air content Qt to acquire the aim air content Qt. Here, the inlet-valve close stage IVC is set to a top dead center side, so that the aim air content Qt is small, and the inlet-valve close stage IVC is set to a bottom dead point side, so that the aim air content Qt is large. The portion of these steps 3 and 4 is equivalent to the 1st inhalation air content control means.
[0027] In the case of a specific service condition, it progresses to step 5, and it fixes valve timing. That is, the inlet-valve open stage IVO is fixed near the top dead center, and the inlet-valve close stage IVC is fixed near the bottom dead point.
[0028] And it progresses to step 6, and the throttle opening TVO is calculated so that the aim air content Qt may be acquired under the valve timing conditions in step 5. That is, with reference to a map, the throttle opening TVO is calculated and controlled from the aim air content Qt and an engine speed Ne. Specifically, the throttle opening TVO is proportionally set up-like to Qt/Ne. The portion of these steps 5 and 6 is equivalent to the 2nd inhalation air content control means.
[0029] When controlling an inhalation air content by the close stage IVC of an inlet valve 5 using an adjustable moving valve mechanism, as mentioned above, at the time of low load operation Although the port rate of flow does not progress but weakening of the gas fluid in a cylinder, slowdown of evaporation of a wall style, etc. are produced as shown in A of drawing 5 since the close stage IVC of an inlet valve 5 becomes early and the open time amount (IVO-IVC) of an inlet valve becomes short that an inhalation air content should be made small By this invention, the close stage IVC of an inlet valve 5 is fixed near the bottom dead point, by taking the long open time amount of an inlet valve 5, as shown in B of drawing 5 , the port rate of flow is fully developed at this time, and improvement in gas fluid in a cylinder, promotion of atomization of a wall style, etc. are aimed at at it. And about the inhalation air content which increases if it remains as it is, it is carrying out throttling control of the air content by the ** system throttle valve 9, and the same inhalation air content is acquired.
[0030] In addition, as a specific service condition switched to control by the throttle valve from control by the inlet valve, the time of moderation operation besides at the time of idle operation and low load operation in the cold machine condition (before a fuel cut) can be mentioned.
[0031] moreover -- this operation gestalt -- as an adjustable moving valve mechanism -- electromagnetism -- although the thing of a drive type was used, the thing of a hydraulic-drive type etc. can also be used.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]
[Drawing 1] The functional block diagram showing the configuration of this invention
[Drawing 2] The system chart of the adjustable valve train engine in which 1 operation gestalt of this invention is shown
[Drawing 3] the electromagnetism of an induction-exhaust valve -- basic structural drawing of a driving gear
[Drawing 4] The flow chart of a control routine
[Drawing 5] Drawing showing the relation between the open time amount of an inlet valve, the port rate of flow, etc.
[Description of Notations]
1 Engine
4 Ignition Plug
5 Electromagnetism -- Inlet Valve of Drive Type
6 Electromagnetism -- Drive-type Exhaust Valve
7 Inhalation-of-Air Path
8 Flueway
9 Fuel Injection Valve
10 ** System Throttle Valve
11 Control Unit
12 Crank Angle Sensor
13 Accelerator Pedal Sensor
14 Air Flow Meter
15 Coolant Temperature Sensor

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DRAWINGS

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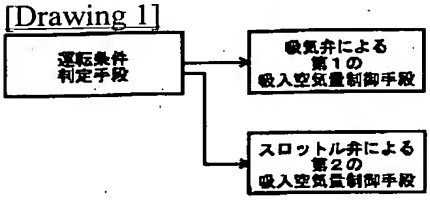
[Drawing 1]

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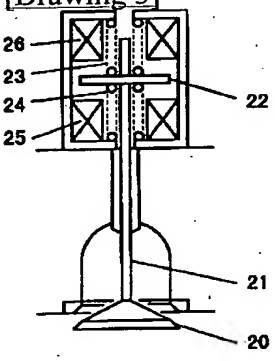


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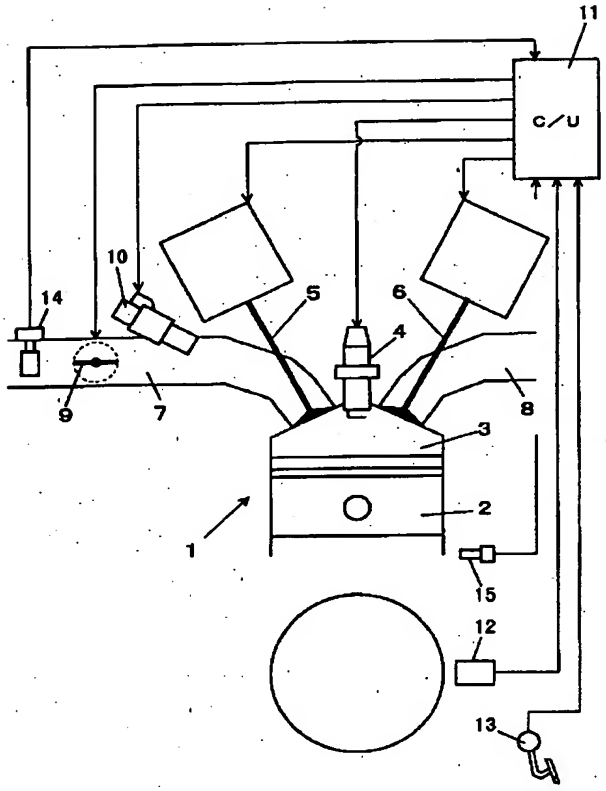


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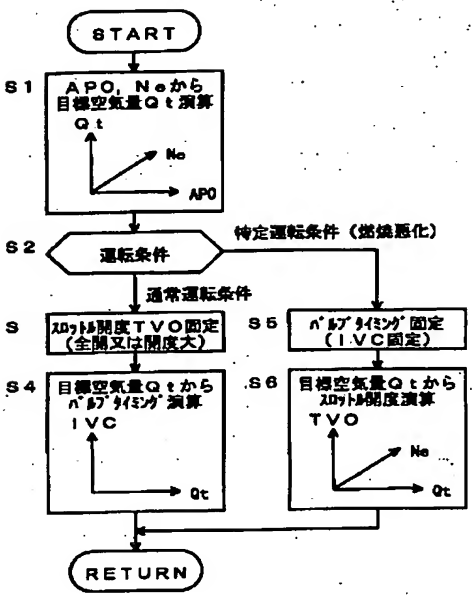


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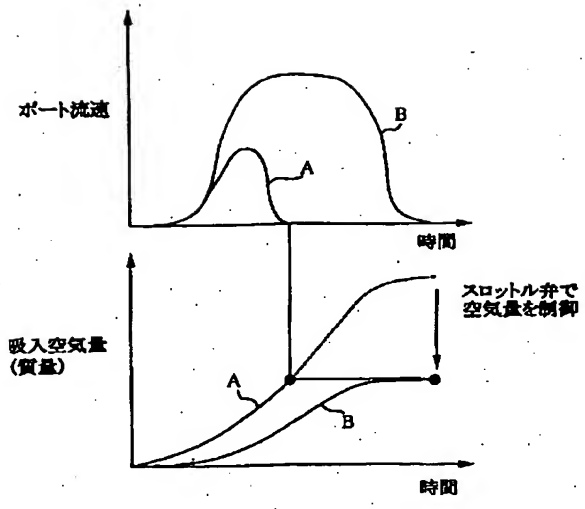


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